

Pesticide and Fertilizer Technical Working Group Final Report

Prepared by the Pesticide and Fertilizer Technical Working Group

As established under the
NYC Watershed Memorandum of Agreement

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New York City Watershed Pesticide and Fertilizer Technical Working Group Final Report

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Pesticide and Fertilizer Technical Working Group Goal and Purposes

Goal

The overall goal of the New York City Watershed Pesticide and Fertilizer Working Group was to report and make recommendations for pesticides and nutrients based on a critical and comprehensive review of their management, use and environmental fate. It is recognized that the review and recommendations of the group may also be relevant and applicable to the rest of New York State. A secondary goal, therefore, was to submit the report for consideration in this wider statewide context.

Purposes

- Analyze New York State and other relevant regulations and standards on the storage, use and application of pesticides and fertilizers;
- Enhance ability to monitor impacts from such storage, use of application, and disposal;
- Recommend any changes to regulations and standards necessary to protect the New York City water supply, and other water resources from potential contamination;
- Specify training materials to be incorporated into the State's pesticide applicator certification program, informing applicators of the potential for contamination of a water supply from improper application of pesticides within the watershed, and recommending that applicators not apply pesticides within an appropriate limiting distance of a watercourse, wetland, reservoir, reservoir stem or controlled lake; and
- Analyze and recommend non-regulatory and voluntary management programs.

Background

Memorandum of Agreement

The New York City Watershed Memorandum of Agreement (MOA) was executed on January 21, 1997 by Governor George Pataki, City Mayor Rudolf Giuliani, representatives of numerous towns and counties and several environmental organizations. The MOA sets up a comprehensive program to protect the quality of water within the watershed of the NYC water supply system and to address the sources of environmental impairment potentially affecting the water supply. It also provides compensation and shared governance programs which increase the involvement of residents of the watershed and other concerned citizens in the prevention of pollution in the system.

In several technical areas, the MOA also provides for further study to increase the parties' understanding of the best approaches to limit watershed pollution, including the potential for new regulations. Among these areas is the use of pesticides and fertilizers. Specifically, the MOA provides for a Pesticide and Fertilizer Working Group to "analyze the State's current regulations and standards on the storage, use and application of pesticides and fertilizers, and to recommend any changes to such regulations and standards to protect the City's water supply

from potential contamination from pesticides or fertilizers or to enhance the City's ability to monitor any impacts from such storage, use or application."

Working Group Members

The working group first convened on March 31, 1997 and consists of the following members: John Wainwright, New York State Department of Environmental Conservation (DEC) (Chair); Michael Sakala and John D'Aquino, Westchester County Health, representing Westchester and Putnam Counties; Keith Porter, New York State Water Resources Institute (WRI), representing the Catskill Watershed Corporation; Robert Mungari, New York State Department of Agriculture and Markets; David Post, Watershed Agricultural Council (WAC); Maureen Krudner, United States Environmental Protection Agency (EPA); Dr. Frank Rossi, Cornell University, representing pesticide applicator trade organizations; David Gordon, Hudson Riverkeeper, representing environmental parties; and David Lipsky, New York City Department of Environmental Protection (DEP). Also, Steve Pacenka of the WRI and David Linehan of Jim Girard Landscaping attended many of the meetings and provided a great deal of expertise to the process.

This working group met on twelve occasions to review scientific data related to potential impacts of pesticides and fertilizers to watersheds. Much of the information was obtained during presentations by noted experts who discussed the following topics:

- Pesticide and nutrient movement from managed turf;
- Nutrient/phosphorus translocation from forest to surface water;
- USGS pesticide monitoring programs in New York surface and ground waters;
- Movement of pesticides from rights-of-ways and the use of buffer strips;
- NYS pesticide registration program;
- NYC DEP watershed monitoring and modeling programs for pesticides and nutrients;
- NYS DEC nutrient monitoring program in the West Branch of the Delaware River Watershed (Robertson Farm);
- NYC Watershed Agricultural Council program to protect water quality through implementation of best management practices;
- NYS pesticide laws, rules and regulations and guidance documents;
- NYS DEC Spills Program, regarding pesticides;
- Hydrological basis of whole farm planning risk assessment;
- The use of pesticides and fertilizers on municipal golf courses and impact on surface waters; and
- NYS Department of Agriculture & Markets Commercial Fertilizer Report.

The working group completed its preliminary review of the existing data on December 17, 1998. With respect to the existence of pesticides in watershed streams, and the contribution of fertilizers to eutrophication in the watershed, the group found little data which might justify new regulations at the outset. Therefore, this Final Report focuses primarily on non-regulatory approaches which may substantially improve current application practices and reduce the threat of contamination where it exists. This document describes the issues of greatest concern to the committee:

- Nonagricultural fertilizer use;
- Nonagricultural pesticide use;

- Agricultural fertilizer use;
- Agricultural use of pesticides; and
- Monitoring and data collection needs for fertilizers and pesticides.

Proposed resolutions and implementation benefits for these issues are identified and discussed in each section.

Issue: Non Agricultural Fertilizer Use

Findings

Eutrophication is one of the foremost water quality problems in the New York City water supply watershed, and probably the premier problem in the Croton system as well as the Cannonsville Reservoir in the Delaware system. The over-whelming majority of research identifies phosphorus as the limiting nutrient for eutrophication in freshwater lakes such as the local reservoirs, and phosphorus control is a key focus of the watershed regulations.

Fertilizers are among several potential sources of phosphorus in the watershed. Other sources including sewage treatment plants, septic systems, sediment runoff and erosion are directly addressed by the watershed regulations and other MOA programs. There is little data on the extent that fertilizer use contributes to the phosphorus loading of the reservoir system.

Nevertheless, the group noted several significant findings which increase the potential for satisfactory results from initial educational and voluntary programs. Those findings include:

1. In general, little phosphorus fertilization is necessary to sustain healthy turf on most soils in southeastern New York State. Information supplied to the working group by Dr. Frank Rossi, Extension Turfgrass Specialist at Cornell University, and others, suggest that a high percentage of the virgin soils East-of-the-Hudson have a phosphorus level adequate to sustain healthy turf. As a result, there is potential for reduction in application of supplemental phosphorus with little impact on managed turfgrass. Phosphorus should only be added when soil analysis identifies deficiencies for growing the designated crop.
2. Stu Klausner, Department of Soil, Crop and Atmospheric Sciences, Cornell University, stated during his presentation to the Working Group on August 6, 1997 that under normal conditions, and absent of gross misuse, most phosphorus applied to soils will remain bound to the soil. Phosphorous is predominately lost from soils via sediment and surface runoff in agricultural settings. However there is increasing evidence that in phosphorus saturated soils, subsurface water flows are sources of dissolved phosphorus.
3. The group agreed with literature presented by Dr. Frank Rossi, Cornell University, that very little turf fertilizer, probably well under one percent of that applied, would leave properly managed lots. Fertilizer leaving a managed plot would be due to misapplication to impervious surfaces and frozen soil. It is also possible for nutrients derived from fertilizers to be taken up by the biomass and leave a lot via wash-off of biomass material (e.g. leaves and grass clippings) deposited onto impervious surfaces. Of course, leaves and other organic matter from unfertilized forests are also sources of nutrients to surface waters. The quality of lawn management and the potential for export of phosphorus from poorly managed or over managed turf is not yet quantified for the NYC

watersheds. This is a notable data gap. For example, a crude estimate of 1997 total nonagricultural fertilizer use in the East-of-Hudson (EOH) watersheds is 67,000 kg of phosphorous (P). This compares to New York City DEP's estimated non-point source loading of 9,000 kg P/year to these reservoirs. Further, a Wisconsin study (Bannerman 1994) found total phosphorus concentrations in lawn runoff to be as high as 2.6 mg/l, ranking it the highest urban area source of that nutrient. However, data are lacking on turf management and fertilizer practices in the watershed. If turf fertilizer and organic matter handling are generally poor, turf could account for a significant fraction of the nonpoint source loading to the reservoir system. If turf management is uniformly excellent, other sources of phosphorous would be dominant.

Recommendations

The working group was not able to identify the magnitude of phosphorous loading to the watershed by the usage of lawn care fertilizers and felt it unnecessary to recommend new regulations at this time. However, until such time that additional research provides a clearer understanding of this issue, the working group promotes a non-regulatory approach to reduce the potential impacts of commercial fertilizer use to the watershed. They also provide potential solutions that are relatively inexpensive and involve consumers and retailers as well as civic groups and industry. They rely on total community involvement as the key to success.

Regulatory mandates may be warranted if voluntary phosphorus education/reduction programs do not lessen watershed impacts and if further scientific study suggests that current phosphorus containing fertilizers pose a significant eutrophication threat. Such mandates could restrict the use of phosphorus containing fertilizers in sensitive areas and possibly require soil testing as a prerequisite for purchase of phosphorus containing fertilizers within the watershed.

Potentially negative watershed impacts caused through the use of commercial fertilizers may be mitigated through a series of non-regulatory proposals, including:

- A pilot "Friends of the Watershed" educational/promotion program should be promoted to identify municipalities and businesses who use "best management practices" to protect the watershed from phosphorus from both point and non-point sources;
- Voluntary reduction or elimination of phosphorus from commercial fertilizers through development of a consumer information/education program on how to protect the watershed from phosphorus containing fertilizers; and development of nutrient recommendations and a soil testing program for consumers; and
- Development and promotion of management practices that reduce potential runoff of phosphorus and other nutrients from treated turf, such as promoting the use of mulching lawnmowers, educating the public regarding transport of phosphorus when grass clippings are blown onto impervious surfaces and community wide composting programs.
- There is a need to develop and collect additional data regarding the impact of non-agricultural fertilizer usage within the New York City Watershed. A greater understanding is needed on the significance of non-point source loading of phosphorous through the use of lawn care fertilizers within the watershed.

Recommendation #1:

The working group did not feel there was sufficient evidence to recommend additional regulations at this time. Until additional information becomes available that can measure the significance of phosphorous loading by lawn care fertilizers to the watershed, other non-regulatory actions should be taken as discussed in the following recommendations to mitigate any potential negative impacts.

Recommendation #2:

The working group recommends a pilot, "Friends of the Watershed Program" to develop and promote best management practices (BMPs) for the use of fertilizers and pesticides. This pilot program would distribute educational information to municipalities, schools, corporations, golf courses, utility companies, fertilizer companies, as well as commercial landscapers, and other interested parties within the watershed, and encourage the use of such BMP's. It might also include criteria for individuals, companies or municipalities to receive "Friends of the Watershed" recognition, including a "Friends of the Watershed" logo for business use. Such a program would be a useful mechanism to involve local landowners and citizens in the reduction of unnecessary fertilizer use. The pilot program could also encourage businesses, utilities, and other facilities with environmental management systems (e.g. ISO1400) to incorporate watershed protection programs as an environmental aspect, to be addressed in their environmental management system.

Recommendation #3:

Unfortunately, most currently available consumer fertilizers contain phosphorus. The working group proposes that the New York State Department of Agriculture and Markets, the New York City DEP, the New York State DEC and the counties within the watershed, approach the principal manufacturers of commercial fertilizers to discuss the voluntary reduction of phosphorus in their products. Products with reduced or eliminated phosphorus, which the Working Group has found are available commercially in some areas of the country, could be awarded "Watershed Seals of Approval" or designated as a recipient of a "Friends of the Watershed Award." These designations could then be used as marketing tools by manufacturers to identify their products as environmentally sensitive.

An article authored by Carol Ann Barth of the Center for Watershed Protection, (Nutrient Movement from Lawn to Street, Watershed Protection Techn., Vol. 2No. 1, Fall 1995) states that nationally, two thirds of all homeowners perform their own lawn care. This combined with evidence that suggests homeowner use of consumer fertilizers within the New York City Watershed appears to be common, especially EOH1, the working group proposes that a "Pilot Consumer Education Program" be developed. Homeowners seldom have the knowledge to properly ascertain soil needs or calibrate and use fertilization equipment. An education program could also include information on control of grass clippings, which may be as likely a source of phosphorus loading as the fertilizer, and on how landscape manipulation can reduce nutrient use and loss.

Important components of this project should include:

- Educate sellers/retailers of commercial fertilizers;
- Develop point of purchase information on proper fertilizer use;

- Develop education programs for students and teachers on how they can protect the watershed;
- Cooperation with fertilizer manufacturers to develop BMP's; and
- Educate Planning/Zoning Board members on how landscape design can impact watershed eutrophication.

To support this recommendation, there is a need to develop and promote a free or minimal fee, soil testing program for consumers. This program could be funded through an EPA grant or other funding source and administered by Cornell Cooperative Extension. The present average homeowner cost for having a soil sample analyzed by Cooperative Extension is \$11.00. This soil analysis will then be used as the basis for making fertilizer recommendations. Since generally all soil types found within this area of the Hudson Valley have sufficient quantities of phosphorus to produce healthy turf, only soils identified as being deficient in phosphorus would be targeted to receive this nutrient. This not only benefits the watershed, but the targeted lawn, shrub, or nursery.

Recommendation #4:

There is also a need to develop and promote management practices that reduce potential runoff of phosphorus from treated turf. A Wisconsin study (Bannerman 1994) found total phosphorous concentrations in lawn runoff to be as high as 2.6 mg/l, ranking it the highest urban area source of that nutrient. As advised by Dr. Frank Rossi, although well managed turf on relatively flat ground seldom produces runoff during normal climatic conditions, runoff will occur following intense storm events. Also many home lawns are on compacted soils, have bare spots and steep slopes and thin turf which promote runoff of nutrients. States such as Wisconsin and Minnesota have developed practices that reduce phosphorus movement from turf areas by promoting the use of mulching lawn mowers, educating the public regarding transport of phosphorus when grass clippings and leaves are blown onto impervious surfaces, and municipal pickup of lawn clippings and leaves as part of a community wide composting program. These and other recommendations should be evaluated and implemented to reduce phosphorus movement to surface waters.

To better protect this watershed, these management practices should consider promoting "low input lawns." The most important element of promoting such a program is knowledge. Homeowners must understand that it is possible to grow and maintain a healthy and visually appealing lawn and grounds, with low inputs of water, nutrients and pesticides. The Working Group suggests utilizing the existing Cooperative Extension system to provide this outreach. A funding source should be developed to support Cooperative Extension.

Recommendation #5:

As indicated in the "issues discussion", the Working Group identified several data gaps that need to be filled before the relative impact of non-agricultural fertilizer usage on the NYC Watershed can be assessed with a reasonable degree of certainty. The first data gap concerns the extent to which applied fertilizer contributes to non-point source phosphorus loading to the reservoir system in urban/suburban areas. While the Working Group agreed with literature indicating that very little phosphorus in commercial fertilizer leaves properly managed lawns and turf, the condition of lawns, the handling of fertilizer and actual loss rates experienced in residential and commercial areas East and West of the Hudson are unknown. Estimates of the phosphorus sold in commercial fertilizer in Putnam and Westchester Counties for 1997, as

compiled by the New York State Department of Agriculture and Markets, was 258 tons. The non-farm purchases totaled 240 tons.

A second data gap, concerns the importance of phosphorus from applied (non-agricultural) fertilizer relative to other potential sources of phosphorus in the urban/suburban landscape such as road dirt and dust, and biomass (leaves, grass clippings). A greater understanding of the sources of phosphorus in suburban watersheds is needed to help identify and prioritize BMPs that might be applicable for reducing non-point source phosphorus loadings in phosphorus restricted basins or basins exceeding their TMDLs for phosphorus. In that context, the Working Group recommends that additional monitoring and modeling efforts be undertaken to quantify phosphorus losses from urban/suburban watersheds. The Working Group suggests that the level of effort and approach be similar to that currently being used by DEP and DEC to assess and model sources of phosphorus (and applicable BMPs) in agricultural and forested landscapes. The effort should include monitoring one of more model suburban watersheds to identify sources and fluxes of phosphorus and the development and application of appropriate calibrated and verifiable terrestrial models to predict phosphorus losses within the watersheds.

Recommendation #6:

Though a great deal of information is available on the use of nutrients in agricultural settings WOH is recommended an assessment be made on the use of non-agricultural fertilizers, especially those used to maintain amenity grasslands WOH and how such use impacts phosphorus sensitive areas. Opportunities to enhance management practices should be sought. Good communication and coordination with parallel work EOH should be sought. The Working Group is willing to foster such linkage between the two watershed regions.

Issue: Nonagricultural Pesticide Use

Findings

Pesticides as well as pesticide application technology, have changed dramatically since the modern age of pest control started with the use of DDT as an insecticide in 1938. No longer does industry rely on organochlorine based pesticides or pesticides containing lead or arsenic to control pests. The broadcast application of pesticides at the pounds per acre rate have often been reduced to ounces per acre and new pesticides are scrutinized during their registration process at a more scientifically stringent level than those of the past. New York State requires all persons who apply pesticides to other than their own residence to be either commercially certified or to work under the direct supervision of a certified applicator. This requirement has increased the general knowledge of pesticide applicators and to a certain extent, reduced the risks associated with using these materials in New York State. Also, integrated pest management (IPM), which relies less on pesticides than traditional pest control, is being utilized by an increasing number of pest control firms. All these factors add up to an industry that is moving forward stimulated both by economic considerations and regulatory mandates. However the Working Group realizes that pesticides can pose a threat to human health and environmental degradation if misused, mishandled or stored unsafely.

The Working Group anticipates that advances in pesticide technology will allow pesticide manufacturers to develop new products that pose less risk to users, the public and the environment and IPM will either become an industry standard or a regulatory requirement. The

Federal Food Quality Review Act will force limitations on using organophosphate pesticides by measuring risks from all aspects of human exposure. When aggregate exposure levels expected in children reach a predetermined threshold, uses of these products will be reduced.

Unfortunately, the homeowner use of pesticides is becoming a greater percentage of the total use nationally, growing at an approximate annual rate of four percent. Homeowners are least apt to apply pesticides at the appropriate time and appropriate rate and will not generally utilize IPM practices to control pests. This pesticide user group is of great concern to the technical working group as are pest control managers who do not utilize IPM techniques as the foundation of their pest management program. In the nonagricultural pesticide arena, these groups pose the greatest pesticide threat to the watershed.

The United States Environmental Protection Agency estimates that 1.2 billion pounds of pesticide active ingredients were used in 1995. This total does not include the use of chlorine for drinking water disinfection or swimming pool use, wood preservatives or biocides such as cooling tower additives. The majority, 77 percent, was used on agriculture, while 12 percent was used in industrial, commercial and government pest control and 11 percent by homeowners. Homeowner use has increased by 14 million pounds since 1979. Herbicides were the most frequently used pesticide accounting for 46 percent of the total U.S. usage. (USEPA 733-R-97-002, Pesticide Industry Sales and Usage - 1994-1995 Market Estimates).

In July of 1996, the New York State legislature amended Article 33 of the ECL requiring all commercial certified applicators to report their pesticide use annually. The law requires applicators to provide pesticide use data for each pesticide application at each location sprayed. The first report was due in February 1998. Unfortunately, this data does not include the use of pesticides by homeowners nor the use of general use pesticides in agriculture when such applications relate to farmers who were not certified pesticide applicators.

Pesticide monitoring studies of the Mississippi River Basin in the 1980s and 1990s, have shown widespread detection of agricultural herbicides such as atrazine, cyanazine and metolachlor. As a result, EPA has required states to develop management plans to protect water quality or lose the ability to register these pesticides. The DEC is working with EPA to develop such a plan. Agricultural pesticides are much better characterized in environmental terms than are nonagricultural pesticides. Pesticides used on golf courses are a notable exception, having been studied extensively since the late 1980s. Less is known about the fate of lawn care pesticides and pesticides used on rights-of-way. The working group reviewed substantial scientific literature and expert presentations related to this topic.

Data on pesticide concentrations within the New York City watershed while relatively sparse, do not at this time provide evidence of widespread and significant impacts associated with pesticide usage in the watershed. However, the Working Group agrees that additional data collection efforts are needed to evaluate the accuracy of this position. A recent assessment of DEP's monitoring program conducted under the MOA by the Institute of Life Science Research (ILSI) also recommended that additional sampling for toxic substances, including pesticides, be conducted, particularly during high runoff events (ILSI, 1998).

The data to support the above conclusion includes the following DEP monitoring programs: The first and most extensive pesticide monitoring program has been performed in the DEP Delaware

District watershed, incorporating the drainages for the Cannonsville, Pepacton, Neversink, and Rondout reservoirs. The watersheds of the Delaware District have abundant agricultural land and the objective of pesticide monitoring in this district was to determine if pesticide use for agriculture could be detected in the water supply source water. The Delaware District pesticide monitoring began in 1995 and consisted of monthly monitoring of the effluents (Keypoints) from the four Delaware District reservoirs for alachlor, atrazine, chlorothalonil, chlorpyrifos, heptachlor, lindane, and methoxychlor. In addition to the Keypoints, selected streams were monitored monthly during the spring runoff months of April, May and June 1996-1998 to assess possible sources of pesticides during periods of agricultural pesticide application. Sample locations of both the Delaware District Keypoints and selected streams are described in Table 1. During the monitoring period from 1995 through 1998 no alachlor, atrazine, chlorothalonil, chlorpyrifos, heptachlor, lindane, or methoxychlor was detected in any sample from the Delaware District.

The second pesticide monitoring program consisted of pesticide scans for approximately 100 compounds at the DEP's Keypoint locations in the entire water supply watershed (Delaware, Catskill, and Croton supply). The objective of this monitoring was to assess the presence or absence of all pesticides in the source water at key watershed and water supply entry locations. The monitoring was performed one time each in 1994, 1997, and 1998 and included analysis for aldicarb (EPA Method 531), herbicides (EPA Method 515), nitrogen and phosphorous pesticides (EPA Method 507), and Safe Drinking Water Act pesticides (EPA Method 508). A description of the sample locations and the years they were sampled are outlined in Table 2. During the monitoring period from 1994 through 1998 no pesticides were detected at any of the DEP Keypoint sample locations.

As required under Part 5 of the New York State Public Health Law, Section 225, prior to 1993, DEP had to monitor quarterly (for one year) at a point in the distribution system representative of each source of water, for a large suite of pesticides as described in Table 9C of the Part 5 regulations. As no pesticides were detected during this initial surveillance round, DEP is now required to analyze one sample every 18 months for each source, and in fact analyzes each source on an annual basis (some constituents are analyzed more frequently on a monthly basis). The results of these analyzes are included each year in DEP's Drinking Water Supply and Quality Statement. To date, the only pesticide detected in the distribution system has been the herbicide dalapon, at an average concentration of 0.6 ug/l (ppb) as reported in the 1997 Annual Statement. However, DEP believes that this low level detection of dalapon (2,2-dichloropropionic acid) may be attributable to an artifact of the chlorination process (i.e. it is a disinfection by product).

In addition to these surveillance programs, DEP has conducted a limited number of other studies at specific locations within the watershed. Specifically, DEP collected samples over a two year period in the Croton, Kensico, and Cannonville basins, under both base flow and storm flow conditions. Water samples are analyzed for specific pesticides using a semi-quantitative (non-ELAP approved) Enzyme Linked Immunosorbent Assay (ELISA) methods so that these results must be interpreted with caution. Several pesticides were detected, but at generally low concentrations. However, after a significant storm event, in one sample, alidcarb was found to have exceeded its MCL using this semi-quantitative method, and atrazine exceeded the MCL in two samples. A study was conducted of chlorothalonil and chlorpyrifos concentrations in surface waters and sediments adjacent to a new golf course in Westchester County during the pre-

construction, construction, and grass grow-in phases. Neither of the two pesticides were detected near the new golf course although low levels of chlorpyrifos were detected in 2 of 14 samples from locations near an old golf course. Finally, a limited study was conducted to determine if specific pesticides could be found in sediment, surface water and ground water samples near or on the grounds of a large corporate office park. None were detected.

As with nutrients, pesticides are less likely to leach through or runoff mature turf grass areas where adequate density is maintained. In the last 15 years, millions of dollars have been spent to investigate the off-site movement of nutrients and pesticides from turf. For example, the Cape Cod Study monitored groundwater quality beneath several golf courses predominately growing on what might be considered high risk soils, i.e. high sand content soils. The results found little measurable pesticides in the groundwater that were likely used on the golf course. Since the Cape Cod study, several Universities have conducted pesticide and nutrient leaching studies, only to come to a similar conclusion. Once a mature turf is established, the high percentage of organic material at the surface, the uptake capacity of the turf grass and the properties of the pesticides and nutrients applied result in concentrations well below health advisory limits.

Regarding surface movement of pesticides, several studies have concluded that under most conditions, i.e. reasonable soil moisture, dense turf, non-frozen soil and following proper application procedures, runoff from turf is limited. Still, fine particle soils under optimum management when soil moisture is high, can result in significant surface movement of water soluble materials. Therefore, best management practices that recommend avoiding application when antecedent soil moisture is high prior to an application, are warranted.

An article published by the Center for Watershed Protection in the Fall of 1995, authored by Tom Schueler, entitled, "Urban Pesticides: From Lawn to Stream", provides an assessment of this issue which raises some concerns. Nearly 70 million pounds of active ingredients are applied to urban lawns in the United States annually, (Kroll and Murphy, 1995). This includes nearly 50 different herbicides, insecticides and fungicides. As previously stated, pesticides generally bind tightly to the soil. Turf researchers report very little runoff or leaching of pesticides from fully controlled lawn test plots. However, researchers are frequently detecting a relatively wide range of herbicides and insecticides in streams at the parts per billion. The Schueler article stated that a review of 12 recent studies indicated that a small group of pesticides, which include those most widely used and marketed, are routinely found in urban runoff. These compounds include the herbicides 2,4-D, MCPA, MCPP and dicamba and the insecticides diazinon and chlorpyrifos. Weekly storm water sampling in Atlanta, Georgia detected diazinon and chlorpyrifos in 89 percent and 65 percent of all samples. Similarly the mentioned herbicides were found in 25 percent to 90 percent of all stormwater samples collected in a Minnesota study. Recent studies by the United States Geological Survey, through their National Water Quality Assessment Program, found diazinon in nearly 90 percent of samples collected from Lisha Kill Creek in Niskayuna, New York at levels ranging from .13 to .55 micrograms per liter. The significance of finding these materials at such low levels is unknown and could be the result of improper disposal of containers or use.

Pesticides applied on rights-of-way may enter surface waters in four ways: direct application to the water body; drift of spray material to the water during and shortly after application; mobilization of herbicides from treated vegetated surfaces or soil during heavy rains; and

leaching of herbicides through the soil profile. However a study published by the Empire State Electric Energy Research Corporation in 1991, entitled, "Determination of the Effectiveness of Herbicide Buffer Zones in Protecting Water Quality on New York State Powerline Rights-of-Way", indicated that little or no herbicides leach or move laterally to surface waters if a 25 to 100 feet vegetated buffer is maintained between the treated area and the water body. The Public Service Commission requires utility companies to provide vegetative buffers.

During a presentation and field trip, Kevin McCloughlin of the State Power Pool discussed the vegetative management programs of its member companies. Maintenance is accomplished on a five to seven year cycle. Today utility right-of-way vegetative management programs involve selective removal of high growing species and promotion of shrubs and native grasses. This approach has reduced the amount of herbicide used on New York rights-of-way dramatically from the total vegetation removal of the pre-1970's. All members of the Power Pool leave vegetative buffers ranging from 10 to 50 feet along streams, ponds and other water bodies.

Data collected by DEC in 1997 , 1998 and 1999 for all rights-of-way applications in Westchester, Putnam and Delaware Counties are as follows:

- 1997 - 422 gallons of Round-up (Glyphosphate), 15 gallons of Arsenal (Imazapyr), 36 gallons of Oust (Sulfometuron), 128 gallons of Krenite (Fosamine), 309 pounds of Karmex (Diuron) and 66 gallons of Tordon (Picloram);
- 1998 - 6 gallons of Round-up, 55 gallons of Arsenal, 87 pounds of Oust, 94 gallons of Krenite, 457 pounds of Karmex and 20 pounds of Tordon;
- 1999 - 1 gallon and 3 pounds of Round-up, 108 gallons of Arsenal, 5 gallons and 265 pounds of Oust, 10 gallons of Krenite, 191 pounds of Karmex and 433 gallons of Tordon.

The accuracy of this data may be questioned, since DEC has not completed their review of the 1998 and 1999 figures.

The impact of low levels of pesticides in runoff from turf or rights-of-way on the environmental or water quality is unclear. As stated in the Schueler article, "In general, the concentrations of most herbicides and banned pesticides in urban runoff appears to be well below the threshold for acute toxicity for most aquatic and terrestrial organisms (Murphy 1992)." The potential for chronic or sublethal toxicity however, is not well documented.

The risks associated with finding diazinon and chlorpyrifos in storm water is much greater. In Sacramento, storm water was found to contain diazinon at levels that eliminated 100 percent of the Ceriodaphnia present. This was at levels of .5 micrograms per liter, which are the same levels found in Lisha Kill Creek, near Schenectady, New York. Although most pesticide samples of surface waters collected in New York are well below drinking water standards, there is not enough scientific data available to evaluate if low levels of pesticides reduce beneficial organisms and what, if any, negative impact it might have on water quality. More research is needed to better understand the biological significance of these low levels of pesticides in surface waters.

Existing Pesticide Regulations

Pesticides are heavily regulated substances in the United States. The federal EPA under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and State Lead Agencies (SLA) are involved in regulating the registration, distribution and use of pesticides. In New York State the SLA is the Department of Environmental Conservation (DEC) who regulates pesticides under Article 33 of Environmental Conservation Law (ECL). The ECL defines pesticide as, "any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any insects, rodents, fungi, weeds, or other forms of plant or animal life or viruses, except viruses on or in living man or other animal."

Both EPA and DEC focus their principal means of regulating these materials through the product registration process. This review process requires registrants to supply data to demonstrate the product's benefit outweighs any risks posed by its use.. In New York, the DEC also requires pesticide registrants to register products before sold or distributed within this state. This review process weighs additional factors identified by the State as concerns involving the environment or human health including any potential for ground or surface water contamination and are enforced under Part 326 of Title 6 of New York Codes Rules and Regulations (NYCRR). The state has restricted or prohibited use of certain pesticides due to their potential to impact groundwater. Some products, such as those containing atrazine and picloram, have mandatory buffers restricting their use near streams, lakes and other water bodies including private wells. This is a regulatory tool which can be utilized to limit use in environmentally sensitive settings, such as these.

Once a pesticide is registered, its label becomes a legal document to which the pesticide applicator must adhere. Part 325 of Title 6 of NYCRR requires all pesticide applicators to follow label directions.

Pesticide applicator certification is another important component of federal and state regulations. In New York, which has stricter requirements than EPA, all pesticide applicators who apply pesticides to other than their own property must be certified as commercial applicators, except individuals using disinfectants for cleaning or sanitizing surfaces or treatment of water or waste (NYCRR Part 325 amended 1/21/2000). However individuals may apply pesticides under the direct supervision of a fully certified applicator. It also requires agricultural growers to be certified to use restricted pesticides. Restricted pesticides are identified by EPA as those posing too high a risk for general public use. To become certified, applicators must have three years of practical experience using pesticides and pass two, 50 question examinations. The exams relate to the specific type of application to be made, i.e. ornamental and turf, structural and rodent, cooling towers, aquatic vegetation, and others. Category specific training manuals exist for each category of certification and play a major role in training commercial applicators. These manuals must be continually upgraded which has been a difficult task. New York has 17 categories of certification and 40,000 plus certified applicators.

Certified applicators must keep accurate records of each application (6NYCRR Part 325) and provide such information in the form of an annual report (ECL 33-0714). Applicators are subject to inspection by employees of the DEC. Approximately 1,200 pesticide use, application record, market place and manufacturer inspections are completed annually by DEC field staff. The Department has 30 field staff to regulate over 40,000 applicators, tens of thousands of sellers of pesticides, thousands of agricultural growers, and hundreds of aquatic permit sites.

Other important state regulations that impact the watershed require aquatic permits to apply pesticides to any water source having an outlet or that is greater than one acre in size (6 NYCRR Parts 327 -329). The DEC's Bureau of Pesticide Management reviews and issues 400 such permits annually, with over 100 in the New York City Watershed. This permit relates to the use of pesticides to reduce or eliminate aquatic insects, vegetation or unwanted species of fish. The permit application is reviewed by various Bureaus within the agency, as well as the New York City Department of Environmental Protection and State and County Health Departments. Property owners having ponds of less than one acre without an outlet, can apply to DEC for a Special Purchase Permit. Approximately 700 of these permits are issued annually statewide, with approximately 50 within the watershed.

There are few specific state or federal regulations regarding the storage of pesticides. NYCRR Part 326, states that restricted pesticides are not to be stored in any manner as may be injurious to man or the environment, and the state's bulk storage regulations (Parts 595-599) require commercial establishments who store hazardous materials, including pesticides, in containers of 1,000 gallons to be registered and storage tanks adequately diked and monitored. Technical Administrative Guidance Memorandum No. 2006 of the Department's Division of Solid and Hazardous Materials provides guidance on disposal of pesticides. Other solid and hazardous waste regulations, Parts 360, 364, 371, 372, and 373 also impact the disposal of certain pesticides.

Principal Users of Pesticides In the Watershed

Users of pesticides within the watershed can be divided into three groups: urban-commercial; agriculture; and homeowner. Although most of the agricultural use is in Delaware and Schoharie Counties and most urban use is in Westchester and Putnam Counties, all counties in the watershed have uses from each group.

Agricultural uses include the raising of crops for dairy production, vegetable and fruit growing, nurseries and greenhouses, forest production and Christmas trees. Urban uses include residential lawn and grounds maintenance, lawn and grounds maintenance for schools and commercial establishments, golf courses, indoor and outdoor control of structural pesticides in homes, restaurants, hotels etc., termite control, aquatic pest control, swimming pools, cooling towers and rights-of-way. Also, community-wide biting fly and gypsy moth programs may exist. Although the new pesticide reporting requirements for commercial applicators will provide some information regarding pesticide use in the state and watershed, it will not provide data regarding homeowner use nor useful data regarding most agricultural use.

Recommendations

In general, the Working Group feels that existing regulations, if enforced, have the ability to provide adequate protection of water quality with three exceptions, storage, disposal and homeowner use of pesticides. However this is based on limited watershed specific scientific data. There is concern that the five DEC pesticide control specialists covering the 16 counties of the Hudson Valley and Catskill

Region can adequately monitor certified applicators and provide oversight of several hundred pesticide aquatic permits in addition to regulating all other aspects of DEC's pesticide management program. Another concern relates to providing commercial and private applicators with up-to-date certified applicator training manuals which include information regarding protection of surface waters within this and other watersheds.

The greatest potential for a major negative impact on the watershed is from a direct introduction of pesticides to surface water by spills, floods or other unexpected events. The DEC should review existing storage regulations from other states, such as Maine, and promulgate such regulations in New York. Many garden centers and major retailers store thousands of pounds of diazinon and chlorpyrifos grub control products and 2,4-D/MCPP weed and feed products outdoors each spring. These facilities are often vulnerable to weather conditions, have no containment systems, and are often close to drains or stormwater discharge systems.

The second potential pesticide threat to the watershed is improper pesticide disposal by homeowners and other pesticide users. Disposing of unwanted or illegal pesticides is a statewide problem. Individuals with old pesticide products, whose containers are deteriorating or whose ingredients have been banned, may choose to dispose of such materials in a way that could impact water quality. County cleanup days seem to be a logical solution to this problem. Several counties have successfully initiated pesticide clean-up/amnesty days, including a few within the watershed. A recent clean-up day in Delaware County collected 42, 55 gallon drums of pesticides. Successful results were also recorded in Putnam and Westchester Counties. In 1997, Westchester County collected over 20 tons of household hazardous waste including pesticides from 1400 homeowners. Putnam County also collected 197, 55 gallon drums of these hazardous wastes.

The third and least known issue, relates to homeowner use of pesticides. Nationally, homeowner pesticide use was estimated by EPA in 1995 to be 147 million pounds of active ingredient, representing approximately 11 percent of the total usage. Since homeowners are less apt to follow label directions than certified applicators or agricultural growers, there may be associated increased risks to aquatic organisms and water quality. As mentioned previously, diazinon and chlorpyrifos have been found to eliminate certain aquatic organisms at levels of 0.5 micrograms per liter. Recent monitoring of a stream in Schenectady County found levels of diazinon at .55 micrograms per liter. A monitoring program should be developed to determine levels of these and other pesticides in watershed streams and water bodies. Regulating homeowners would be a difficult task. Until watershed specific scientific information becomes available, the Working Group feels a need to recommend a conservative but pro-active non regulatory approach to reduce potential impacts associated with homeowner use of pesticides.

Since no scientific literature was found to identify whether homeowner use of 2,4-D, MCP, MCPA, dicamba, diazinon or chlorpyrifos was a greater contributor to surface water contamination than commercial users, the working group recommends that strong educational programs be targeted to both groups of pesticide users. These educational programs should emphasize integrated pest management (IPM), which is a systematic approach to managing pests. IPM promotes long-term prevention or suppression with minimal impact on human health, the environment, and non-target organisms. IPM also incorporates reasonable measures to prevent pest problems by properly identifying pests, monitoring population dynamics, and

utilizing cultural, physical, biological or chemical pest population control methods to reduce pests to an acceptable level.

Recommendation #1:

The "Friends of the Watershed Program" mentioned in the nonagricultural fertilizer recommendations, should be promoted for users of pesticides and fertilizers. This pilot program would promote the concepts of IPM to commercial applicators and the accounts they service. A concerted effort should be made through Cooperative Extension, DEC, local agencies and with industry cooperation, to develop and implement standards of pest control compatible with protecting water quality, and to recognize those who utilize these standards. This community based program would protect water quality and promote a scientific approach of pest control to schools, municipalities, corporations, golf courses, utility companies, landscapers etc. A good example of an existing program qualifying as a "Friend of the Watershed" is Westchester County's Mohansic Golf Course. The Golf Course's IPM approach to controlling pests has practically eliminated most pesticide use since its implementation in 1992. Also, a pilot program introducing a biological system approach to control fungus is underway at the County's Dunwoodie Golf Course. These two programs should be supported and used as examples.

An important component of this recommendation is for DEC to become more involved in promoting IPM concepts through its pesticide certification program. The DEC should develop IPM training, in cooperation with Cornell Cooperative Extension and industry, that takes into consideration, pesticide/water quality issues. Pesticide certification examinations should include questions related to how pesticides can impact water quality and how to mitigate such impacts.

Since homeowners employ pest control companies or apply pesticides themselves, it is essential to provide them with educational/outreach training and information regarding the benefits of IPM. Resources should be made available to accomplish this task.

Recommendation #2:

The DEC should develop and promulgate regulations for the commercial storage of pesticides. The State of Maine's storage regulations would serve as a guide for development of these rules. The Working Group feels that the greatest threat to the watershed relates to undiluted pesticides entering storm water systems or streams, due to poor storage facilities. Each spring thousands of pounds of lawn care pesticides are stored outside at garden centers and large chain stores, often without proper covering from the elements nor emergency containment measures in case of spills, fires, etc. Also, commercial lawn care facilities have large amounts of pesticides in often inappropriate storage facilities.

Recommendation #3:

Disposal of unwanted, damaged or illegal pesticides by homeowners, commercial applicators and farmers is a major concern of the Working Group. The DEC, EPA, NYCDEP and county governments should work together to coordinate and help fund pesticide cleanup days. In 1997 Delaware County's cleanup day collected 42, 55 gallon drums of pesticides, Putnam county 197, 55 gallon drums household hazardous waste including pesticides, while Westchester County collected 20 tons of household hazardous waste including pesticides. Many counties across New York have similarly collected hundreds of thousands of pounds of pesticides during the past 10 years. Oneida County has year round pesticide collections. These collection programs are a vital component to any water quality protection program and should be promoted.

Recommendation #4:

The Working Group is concerned whether present staffing levels can provide appropriate assurances that label and permit mandates are being followed as required in 6NYCRR Parts 325 and 327-329. DEC should provide increased oversight of the approximately 150 aquatic applications made annually within the watershed. DEC should increase its efforts to locate illegal pesticide businesses not registering or employing certified applicators.

Recommendation #5:

A comprehensive monitoring program and data collection/evaluation system is needed. (This is more fully discussed later in this report.) Oversight of such activities should be provided by a Peer Group consisting of technical/scientific staff from participating Federal, State, City and County agencies, and environmental groups with annual reporting responsibilities to the Executive Committee.

Recommendation #6:

A "New York City Watershed Guide to Reduce Water Pollution at Home" should be published and distributed similar to the booklet prepared for the protection of Long Island Sound. Such a document should also cover soil erosion, runoff and septic systems in addition to pesticides and fertilizers. Fundamental to watershed protection is the importance of managing and caring for one's own property. A watershed protection program will more often than not manifest itself locally. Raising awareness that the extraneous use of pesticides may pose risks to an on-site well, a small community water supply, impact a local swimming lake or even cause unnecessary exposure to children playing in their neighborhood is important in achieving watershed protection.

Recommendation #7:

Although aerial applications of pesticides within the watershed are rare, historical events such as the gypsy moth spraying in the 1960's and 1970's and the recent mosquito spraying to control the spread of the West Nile Virus, do concern the Working Group. Since these types of programs apply pesticides over large acreage, the Working Group recommends that the DEC evaluate the need, if any, to develop additional regulations or policies to aerially apply pesticides for non-agricultural purposes including those related to public health, within any watershed that contains surface water impoundments as public drinking water supplies. Aerial applicators and program sponsors must consider potential hazards to watersheds when developing their pest management system.

Recommendation #8:

If training and testing of commercial users of non-agricultural pesticides is a key component to protect not only the people who apply them, but also the environment, including watersheds from potential contamination, there must be assurances that training manuals are updated on a routine basis. These manuals, especially those related to lawn care and the liquid application of termiticides, should include training and information regarding protection of the New York City Watershed.

Issue: Agricultural Fertilizer Use

The MOA was unclear on how broadly the Working Group should interpret the term "fertilizer" or whether the Working Group should include recommendations related to agricultural fertilizer

use in this document. The definition of fertilizer according to Webster's Third New International Dictionary is: A substance (as manure, lime, or commercial fertilizer) used to fertilize soil. The term fertilizers as used in the terms of reference specified in the MOA for the Technical Working Group is not defined. The only statutory definition found is for commercial fertilizers under Article 10 of New York State Department of Agriculture and Markets Law . It states, "commercial fertilizer is any substance containing one or more recognized plant nutrients which is used for its plant nutrient content, and which is designed for use or claimed to have value in promoting plant growth, except unmanipulated animal and plant manures, agricultural liming material, wood ashes, gypsum and other products exempted by regulation of the commissioner". There was some debate late in the proceedings of the Working Group whether or not we should adopt the narrower term 'commercial fertilizers' (which excludes manure), as opposed to 'fertilizers'. However, there seems little practical ground for such an adoption since the evaluation of commercial fertilizers in their use necessitates consideration of other materials that might also be used as a source of plant nutrient. Hence the dictionary definition was followed.

Findings

Concerns about the potential impacts of the agricultural uses of fertilizer on water quality within the Watershed have been focused on lands WOH, and particularly in the Cannonsville Reservoir Basin in Delaware County. The Cannonsville Reservoir provides approximately sixteen percent of the total storage capacity of the New York City Supply System, and the Basin is currently phosphorus restricted and exceeds the State's Phase I TMDL for phosphorus (1). Agricultural activities are more substantive in this basin compared to other parts of the Watershed. Moreover, DEP scientists have concluded that agriculture is one of the primary sources of phosphorus in this Basin. However, there are agricultural activities EOH too, and the potential impacts of the agricultural uses of fertilizer EOH also needs to be assessed.

The Working Group was advised that fertilizer use on farms in the watershed remains significant although the acres in production decreased throughout the watershed system. Due to economic demands, existing farms use less fertilizer and more closely manage their manure, which is an important source of nutrients for crop growth. The biggest issue concerning nutrients relates to phosphorous runoff from fields to which manure has been applied.

The Working Group was also apprised of several substantive programs being undertaken by various stakeholders in the Watershed that hold the promise of providing additional scientific data upon which to assess actual impacts of agricultural fertilizer use and to evaluate the effectiveness of BMPs for reducing any unacceptable impacts from fertilizers and other point and non-point sources and improving water quality. These include, but are not limited to the following: 1) monitoring and modeling efforts; 2) whole farm planning activities; 3) Development of a comprehensive strategy in Delaware County.

Monitoring and Modeling Efforts

Any regulatory or non-regulatory programs addressing agricultural fertilizer use must be based on sound and defensible scientific information. To that end, the Working Group is encouraged by the substantive efforts undertaken in the Watershed by DEP, DEC and others to understand and measure the sources, fate and transport of phosphorus from different land-uses and to

assess the impacts of the phosphorus on water quality. These efforts, some of which are mandated under the MOA and/or FAD include the development of terrestrial models to assess loading of phosphorus from different land-uses and hydrodynamic/eutrophication models to assess the fate and impact of the phosphorus on water quality in the CAT/DEL reservoirs. These efforts also include the development of total maximum daily loads (TMDLs) for phosphorus, with the Phase I TMDL accepted by EPA in April, 1997, and with a Phase II TMDL expected to be promulgated by NYSDEC shortly. While these efforts have generally focused on the basin or sub-basin scale, the Working Group is encouraged by efforts currently being undertaken through SDWA monies, to evaluate the sources and transport of phosphorus at the farm-scale. The research includes increasing stakeholder involvement in the design and assessment of the monitoring programs. These efforts build upon the long-term research of water quality in the basin that continues to be undertaken by the DEC. This research, which was begun in the 1980s, has demonstrated that the principal sources of phosphorus delivered to the Cannonsville Reservoir originate from non-point sources for all years since 1980. These studies suggest that the greatest single contributor is land-disposed manure.

The Working Group believes that these monitoring and modeling efforts should be encouraged and adequately funded, in order to ensure that any future regulatory or non-regulatory programs addressing agricultural fertilizers are based on sound and defensible data. The Working Group supports the inclusion of different stakeholder groups in the design and assessment of the monitoring efforts.

Watershed Agricultural Programs

The Watershed Agricultural Program's (WAP), which is administered by the Watershed Agricultural Council (WAC), priority has been protozoan pathogens that can potentially impact human health through exposures in drinking water. Phosphorus has been addressed to a modest extent but, has only recently become a more critical issue to the WAC since the Council became aware of the management implications of the Cannonsville Basin being declared phosphorus restricted by New York City Department of Environmental Protection. As part of the WAP, Whole Farm Plans have been developed and practices implemented to manage pathogens and phosphorus in and around farm facilities. These measures are likely to have had some benefit in reducing the risks of phosphorus losses to streams. However, it is desirable to consider the entire phosphorus balance on the farms. It is now well recognized that purchased feed concentrates are the largest source of phosphorus input to dairy farms. This is a new focus for management. Most of the phosphorus in imported feeds is excreted in the manure. The vast majority of manure is applied to the cropland for crop production.

Nutrient management plans developed by the program to manage phosphorus on cropland, until recently, have been modest and rudimentary; however the program is evolving. Until June of 1999 Nutrient Management Plans to manage the majority of nutrients applied to the land in the form of manure have been a lower priority than implementing structural practices that address phosphorus runoff. Nutrient Management Plans that will be developed in the future including revised Plans will provide a much more comprehensive approach to phosphorus management on the land. This will require retrofitting Whole Farm Plans to do a better job of managing phosphorus.

There are three barriers for phosphorus management in Whole Farm Plans. The first barrier is considered to be the initial source of potential contaminants, especially the barnyard area. A particular management issue associated with the first barrier is the question of feed imports to farms. The second barrier is the farm field. This second barrier is the weakest link in the management chain. More comprehensive nutrient management plans based on delineation of hydrologically sensitive areas (HSAs) on each farm field will improve the management of this barrier and WAC has agreed to develop them. HSA delineation of farm fields will also reduce the risk of runoff from nutrients. In the near future the program will be able to adopt a HSA delineation process based on research developed by Cornell scientists for the program. The third barrier is the stream corridor. In that regard, a key program, which recently began, is the Conservation Reserve Enhancement Program (CREP). This program will allow for implementation of phosphorus management plans for the stream corridor. These programs have been sought after in Whole Farm Plans but have heretofore not been attainable because of a lack of farmer incentive to adopt riparian buffer conservation practices that take crop and pasture land out of production. USDA's recent enhancement of traditional Conservation Reserve Program land rental rates through CREP has now provided that needed incentive.

Delaware Comprehensive Strategy

Under the MOA, Delaware County has undertaken the creation of a Comprehensive Strategy to address water quality management issues. Given the importance of phosphorus in the Cannonsville Reservoir Basin, the strategy primarily addresses that issue. However, the Working Group recognizes that components and methods adopted to protect the Cannonsville Reservoir will have relevance and applicability elsewhere. In addition, other important constituents will be considered in the strategy as appropriate – such as nitrogen and pathogens.

The Delaware County Comprehensive Strategy is currently about to complete its first phase development. Principal partners in the development are the Delaware Board of Supervisors, the Catskill Watershed Corporation and the Watershed Agricultural Council. The NYC Department of Environmental Protection (DEP) and the DEC are also participants in the technical formulation of the strategy conjunctively with other agencies including the USDA-Natural Resources Conservation Service and the NYS Soil and Water Conservation Committee. This inter-agency scientific support for the strategy is coordinated through the NYS Water Resources Institute.

The key to the strategy is to formulate individual management practices to quantifiably reduce phosphorus loading. This formulation must ensure the practices are economically acceptable to business persons, residents, farmers or community leaders concerned. For example, with respect to fertilizers, the DEC strongly supports its recommendation that manure surpluses be transported from farms, treated, and disposed in an economically and environmentally sound manner. Such a recommendation to be feasible must provide for significant changes in fertilizer management on farms – such as a significant increase in the use of commercial fertilizers to compensate for the loss of the organic fertilizer. It also will require innovative approaches to ensure costs of collection, transport and treatment and ultimate use/disposal of the manure are reasonably practicable.

More generally, the Delaware County Strategy has specified three categories of BMPs: BMPs with an established good qualitative understanding. These BMPs will be documented with the specified design loading, and recommended in a list of options from which selection can be

made for immediate adoption and approval. Monitoring of such BMPs will primarily consist of verifying the continuance of the BMPs in practice, in conjunction with the broader background of water quality monitoring performed by the DEP. BMPs with lesser quantitative understanding. BMPs which are determined to have an insufficient scientific knowledge will be recommended for adoption and provisional implementation in conjunction with monitoring.

In order to be an effective method of addressing issues associated with agricultural uses of fertilizers, the Working Group believes that the Delaware County Comprehensive Strategy must produce an approach to watershed protection that is comprehensive, proactive, and implementable. It should also be adequately funded both for the purposes of strategy development and for implementation. Finally, the Working Group also believe that the Comprehensive Strategy should have a clear commitment and support from all of the stakeholders, including the highest levels of government, and vision for implementation that addresses basin level concerns as well as concerns at the farm level. As of this writing, the Working Group has not evaluated the adequacy of Phase I of the Work Plan. Therefore, the benefits of this approach (developing a Comprehensive Strategy) for addressing agricultural fertilizer use cannot be determined at this time. The Working Group recommends that the Work Plan be reviewed by the Group at a later date of should be subject to outside peer review in another forum or venue.

Non-farm users of fertilizers, such as on amenity grasslands in the WOH watershed system is, at this time, undetermined. This use seems unlikely to be more a major consideration in the Catskill/Delaware Watershed. However, where there is a phosphorus restriction, it would appear prudent to ascertain the desirability of improved uses of such fertilizers to give desirable reductions in loading of phosphorus while preserving the grassland amenities.

There is sparse information on farm use of fertilizers EOH (e.g. on horse farms and nurseries) and in counties other than Delaware County. Moreover, there are a much smaller percentage of farms in these other counties participating in the Whole Farm Planning process. The Working Group recommends that an assessment be made on the cost and benefits of expanding the Whole Farm Planning process to these other agricultural establishments.

Recommendations

Overall, the Working Group did not have sufficient resources to analyze fully, the impact of the agricultural uses of fertilizer on water quality within the NYC Watershed. The potential significance and impacts associated with agricultural fertilizers continues to be assessed by scientists from academia, as well as by scientists from DEP, DEC, the WAC and other regulatory agencies. However, the Working Group is encouraged by the number of ongoing programs that address the issues associated with agricultural fertilizers, and to that end, has several recommendations that we believe build upon these ongoing efforts. These include:

Recommendation #1:

The Working Group has recognized, particularly by its focus on the Croton System, the importance of meeting the requirements of phosphorus restrictions and TMDLs for phosphorus. There are significant parallels in methods and purposes between restricted basins East of Hudson (EOH) and West of Hudson (WOH), the Working Group recommends communication and cooperation between both regions of the watershed system to an extent that is feasible

and helpful. This recommendation has been made, in particular, by DEC and DEP. The Working Group is willing to serve this coordinating function for both regions of the watershed system.

Recommendation #2:

A first step to ascertaining the needs for phosphorus management on a farm (or other site) is to calculate annual phosphorus budgets for the sites. In varying degrees, such calculations are already made in the Watershed Agricultural Program. We recommend that such calculations be made uniformly to estimate the amount of phosphorus that exceeds annual crop requirements as a basis for supporting desirable management decisions.

Recommendation #3:

Scientists from DEC and WAC believe that land disposal of livestock manure is a significant contributor of phosphorus to the Cannonsville Watershed, and have recommended a feasibility study be undertaken to identify and assess options to collect, treat, and dispose or better use this animal waste. This recommendation is also being seriously considered as a component in the Delaware County Comprehensive Strategy. The Working Group endorses the recommendation recognizing that any management system for such organic fertilizer must be economically, as well as environmentally, acceptable.

Recommendation #4:

DEC scientists suggest that traditional BMPs conventionally applied may be sufficient to reduce phosphorus loads to desirable levels. Assuming funds will be provided, it is recommended farmers evaluate the desirability of additional management measures, especially in farm fields (barrier 2) and the stream corridor (barrier 3). The Strategy for the Cannonsville Reservoir Basin provides an opportunity to reexamine traditional BMPs together with a consideration of new and innovative approaches to phosphorus management.

Recommendation #5:

Though a great deal of information is available on the use of nutrients in agricultural settings WOH is recommended an assessment be made on the use of non-agricultural fertilizers, especially those used to maintain amenity grasslands WOH and how such use impacts phosphorous sensitive areas. Opportunities to enhance management practices should be sought. Good communication and coordination with parallel work EOH should be sought. The Working Group is willing to foster such linkage between the two watershed regions. (Also listed as Recommendation #6 in the Non-Agricultural Use of Fertilizer Section)

Recommendation #6:

WAC should expand its work with farms and agricultural entities such as small farm operations, nurseries and greenhouse operations, including those establishments EOH.

Recommendation #7:

The Working Group recommends expanded monitoring and modeling of farm runoff and the effectiveness of BMPs.

Recommendation #8:

Cornell scientists have shown there is a considerable promise of being able to reduce phosphorus losses from farms by integrated feed management. This management option has

the considerable appeal of directly offering improved farm productivity while reducing costs to the farmer. We recommend this option be pursued both to benefit the farmer and water quality.

Issue: Agricultural Use of Pesticides

Findings

It has now been well documented in most parts of the country that significant levels of five corn herbicides are often found in surface waters. Those herbicides are atrazine, cyanazine, metolachlor, alachlor and simazine. As a result, the EPA required manufacturers of atrazine to modify their labels by prohibiting its use within 66 feet of streams and 200 feet of impounded lakes and reservoirs. Data on pesticide concentrations within the New York City watershed while relatively sparse, do not at this time provide evidence of widespread and significant impacts associated with pesticide usage in the watershed. However, the Working Group agrees that additional data collection efforts are needed to evaluate the accuracy of this position. A recent assessment of DEP's monitoring program conducted under the MOA by the Institute of Life Science Research (ILSI) also recommended that additional sampling for toxic substances, including pesticides, be conducted, particularly during high runoff events (ILSI, 1998).

In 1996 the EPA proposed a rule requiring states and tribal governments to develop pesticide management plans detailing actions to protect groundwater from contamination by five herbicides commonly used on corn. (See 40 CFR Parts 152 and 156 - Pesticides and Ground Water State Management Plan Regulations: Proposed Rule; June 26, 1996.) The proposed rule also includes requirements for states to monitor groundwater for pesticides. To date, a final version of this rule has not yet been promulgated. However, EPA has for many years, encouraged states to begin developing their plans in anticipation of the final rule. As a result, the DEC instituted a voluntary Corn Herbicide Management Plan in 1995 that would fulfill the educational requirements for this federal plan and extend the planning to include all pesticides used on corn. The DEC is also developing a Long Island Pesticide Management Plan which may provide a model for other watersheds, including this one.

In 1997, under the auspices of the New York Pesticide Reporting Law, ECL 33-0714, the Department started a water quality monitoring program throughout the State to meet the proposed federal requirements for pesticide monitoring. In the future, the State intends to develop its plan to include protection of surface waters as well as ground waters. In addition, the State plans to work with local partners to extend the educational and monitoring efforts of the plan to any areas where pesticide use has the potential to cause significant impacts to public health and the environment. We anticipate that the work conducted within the New York City Watershed will be an important component of New York's plan.

The primary area of agricultural pesticide usage within the watershed is in Delaware County and is comprised primarily of dairy farmers. The Watershed Agricultural Council (WAC), as part of its "Whole Farm Planning Program" is providing guidance on pesticide use to its cooperating farms. The amount of pesticides used in this area is not known. However, the WAC does collect, as part of its environmental review/problem diagnosis process, pesticide data for each farm. Unfortunately, we did not have the opportunity or resources to extract that data from its farm files. WAC estimates that 50 percent of the farms contract with commercial applicators to apply needed pesticides. The state's Pesticide Reporting Law requires all commercial applicators to file

annual reports. Although this 1997 use data is the first collected under this new law and not necessarily a true reflection of commercial use, it suggests only small amounts of pesticides are used in Delaware County. The total amount of triazine herbicides reported by commercial applicators in Delaware County was simazine 155 lbs., alachlor 70 lbs., Atrazine 4L 127 gal., Atrazine Nine-O 127 gal. and cyanazine 254 lbs. If this represents 50 percent of the total use, approximately 479 lbs. and 254 gallons were used in the County during 1997. Since use rates average from two to four pounds per acre, this represents treatment on only 200 to 350 acres.

Although only a small number of acres are being treated with corn herbicides, the location of these fields may influence the need for monitoring of nearby streams. Also, these herbicides are restricted and can only be used by trained certified applicators.

Although WAC collects pesticide use data and provides storage facility recommendations, it has had limited interactions with farmers regarding the use of herbicides. Making such recommendations could help reduce movement of herbicides from treated fields following heavy rains. Also, little monitoring for the presence of herbicides has been done in this portion of the watershed.

Other areas in the watershed have orchards and nurseries who use pesticides. Most of these establishments are East of the Hudson River. In fact, there are 75 landscape nursery centers in Westchester County alone. These agricultural establishments are not involved in WAC's planning process. Since applications of pesticides on nurseries do not require filing of annual reports, there is no use data available for this group.

Recommendations

When reviewing recommendations for farms in a Whole Farm Plan, WAC should remind growers of label restrictions on buffers when using atrazine and encourage adoption of pest management practices that are least apt to introduce pesticides to surface waters. Since an estimated 50 percent of farmers in Delaware County have their pesticides applied by a commercial applicator, some effort needs to be made to train these applicators on methods to reduce surface water contamination. Also, if old drainage systems exist in fields treated with herbicides, outflows should be rerouted to prevent emptying directly into streams.

Although WAC collects pesticide use data as part of their preliminary farm audit, a procedure should be established to periodically collect pesticide use information. This information would be valuable in developing a monitoring program or designing modeling protocols. Pesticide storage, mixing and loading site standards should be developed and implemented as part of Whole Farm Plans. Studies of pesticide contaminated ground and surface water in the mid-west and in New York have been directly linked to mixing and loading sites. WAC should work with Cornell and other colleges, as well as industry, to develop a reasonably-priced mixing and loading site system. As an alternative to regulatory mandates on farm pesticide storage facilities, the Working Group supports voluntary compliance through a WAC approved storage guideline.

WAC should continue to increase its involvement with nurseries and other non-dairy establishments. These types of agricultural establishments should be included in the "Friends of the Watershed" and IPM proposals.

Also, DEC working with Cornell's Pesticide Management and Education Program should develop commercial and private pesticide applicator certification training manuals that include watershed and water quality protection information and place more emphasis on pesticide water quality issues in their examination programs. Farmers should be encouraged through WAC to use Certified Crop Advisors.

Recommendation #1:

The protection of the environment, including drinking water systems, from misuse of pesticides is promoted by the stringent product registration review process of both EPA and the DEC and the training and examination process for farmers to apply restricted pesticides or commercial applicators to apply any agricultural pesticide. It has been well documented in many parts of the country, that significant levels of several commonly used corn herbicides are routinely found in surface waters. Although little data is available regarding monitoring of these and other agricultural pesticides in the New York City Watershed, providing users of agricultural pesticides with up-to-date technology on how to limit drift, leaching and run-off of these chemicals is important. To emphasize that point, it was noted in the New York City Watershed Agreement that DEC must update certified applicator training manuals to include information to protect the watershed from pesticide contamination. To meet that concern and mandate, the DEC should work with Cornell's Pesticide Management Education Program to update pesticide certification training manuals for all private and commercial agricultural categories, to include training on protecting the New York City watershed from pesticide use. It should also develop and promote other pesticide watershed protection educational programs targeted towards growers, commercial applicators and crop advisors.

Recommendation #2:

The WAC should be funded to develop, in cooperation with Cornell, other educational institutions, and industry, cost-effective pesticide loading and storage facilities. The DEC, WAC and county governments should continue to provide periodic pesticide clean-up/amnesty days to handle unwanted agricultural pesticides. The Working Group has a serious concern regarding these issues and feels that pesticide filling areas, and improper storage facilities provide a threat to the resource as does improperly disposed pesticides.

Recommendation #3:

WAC should continue its work with nurseries and other non-dairy agricultural establishments to develop and promote BMPs for those types of agricultural establishments. Also efforts should be made to include these entities in the "Friends of the Watershed" and "IPM" proposals previously mentioned.

Recommendation #4:

The WAC should encourage growers to use Certified Crop Advisors.

Recommendation #5:

The WAC should review surface water field drainage systems on farms in its program to determine if they discharge pesticides and nutrients directly to streams.

Recommendation #6:

The WAC now collects pesticide use data as part of their farm management program. Discussions should be renewed concerning WAC providing pesticide use data by watershed

basin or sub-basin to DEC and DEP when such information is needed to develop surface water monitoring programs or modeling protocols for estimating pesticide loading rates. Information would not need to be provided so that individual farmers are identified.

Monitoring and Data Collection Needs for Fertilizers and Pesticides

At present time there is little data available to understand the environmental fate of commercial fertilizers and pesticides in this watershed. However, the working group realizes that a great deal of effort and resources are now being developed and made available for monitoring various contaminants that threaten the watershed. In that light, the following recommendations should be considered as important components when designing these monitoring strategies.

Phosphorous

- Review soil test data available at Cornell to determine "need" for supplemental phosphorus for agricultural and non-agricultural lands;
- Monitor "controlled" sites with varying land-use classifications to quantify potential phosphorus loss in runoff;
- Quantify the relative contribution of phosphorus to the system through the use of consumer fertilizers applied for landscape purposes;
- Identify fertilizer use by land use classifications;
- Ascertain the effectiveness of implemented BMPs within various land use classifications;

Pesticides

Conduct a pesticide use study to determine what is being used, where they are used, by whom are they used and if they are being used correctly. The use study should include both commercial and private applicators as well as homeowners:

- Monitor under both base flow and storm flow conditions to determine if pesticides are reaching surface water, either through surface or ground water base flow;
- Monitor to determine if IPM-implemented programs reduce pesticide runoff;
- Monitor streams to determine if aquatic organisms are affected by low concentrations of insecticides.

Objectives of Monitoring and Data Collection Needs for Fertilizers and Pesticides

The objectives of a monitoring system would be to:

- Determine if phosphorus and pesticide runoff occurs from various turf sites within the watershed;
- Determine use patterns for pesticides and fertilizers;
- Determine if insecticides, such as diazinon and chlorpyrifos, are reaching water systems at high enough concentrations to cause declines or changes in populations of aquatic organisms such as daphnia;

- Develop information on the distribution of pesticides in each of the reservoirs that make up the NYC Water Supply System to facilitate selection of representative monitoring points;
- Develop information on long term trends in current use pesticide concentrations found at representative monitoring sites;
- Understand the input (seasonal highs, and base-flow levels) of current use of pesticides in the various sub-watersheds to identify areas where education and other mitigative efforts should be focused. This information can also provide a baseline for evaluation of the efficacy of future mitigative efforts;
- Investigate the occurrence of pesticides, especially the more mobile and toxic pesticides, reported as being used but not showing up, in existing monitoring analytical scans;
- Investigate the occurrence of "inert ingredients" and metabolites of concern from products heavily used in the watershed and having the potential to cause environmental or public health threats;
- Understand the presence of current use and older pesticide residues in sediment within the watershed, and their potential impact, if any, on of drinking water supplies;
- Determine if phosphorus fertilization based on soil tests and tissue test levels (applicable to golf courses) reduces phosphorus runoff from turf sites within the watershed, or if a new set of phosphorus guidelines should be developed to include the effects of phosphorus on growth and development to maintain healthy turf;
- Determine if removing a significant amount of the turf canopy in the late fall will reduce the amount of runoff carried by tissue leakage as a result of freezing; and determine the effects of tree leaves on phosphorus runoff from turf; and
- Determine if the use of deicing and sanding materials contain phosphorus which pose risks.
- Determine if environmental management systems, pollution prevention programs, or other non-regulatory methods can be effective in reducing phosphorus and pesticide releases to the watershed.

Table 1. Delaware District Pesticide Monitoring Site Locations

Sample Site	Description	Sampling Dates
<i>Keypoints</i>		
RDRr	Rondout Reservoir effluent to the Delaware Aqueduct	monthly, 1995-1998
NRr2	Neversink Reservoir effluent at Rondout Reservoir	monthly, 1995-1998
PRr2	Pepacton Reservoir effluent at Rondout Reservoir	monthly, 1995-1998
WDTO	Cannonsville Reservoir effluent at Rondout Reservoir	monthly, 1995-1998
<i>Streams</i>		
RDOa	Rondout Creek, above Rondout Reservoir, Rondout Watershed	monthly, April-June 1996-1998
RGb	Chestnut Brook, below the Grahamsville WWTP, above Rondout Reservoir, Rondout Watershed	monthly, April-June 1996-1998
NK7a	Neversink River, above Neversink Reservoir, Neversink Watershed	monthly, April-June 1996-1998
PMSb	East Branch Delaware River, below Margaretville WWTP, above Pepacton Reservoir, Pepacton Watershed	monthly, April-June 1996-1998
EDRa	East Branch Delaware River, above Roxbury WWTP, Pepacton Watershed	monthly, April-June 1996-1998
P7	Terry Clove, Pepacton Watershed	monthly, April-June 1996-1998
WDH0m	West Branch Delaware River, above the Hobart WWTP, Cannonsville Watershed	monthly, April-June 1996-1998
C79	Little Delaware River, Cannonsville Watershed	monthly, April-June 1996-1998
C7	Trout Creek, Cannonsville Watershed	monthly, April-June 1996-1998
WDBN	West Branch Delaware River, above Cannonsville Reservoir	monthly, April-June 1996-1998

Table 2.DEP Keypoint Pesticide Monitoring Site Locations

Sample Site	Description	Sampling Dates
<i>Delaware</i>		
RDRr	Rondout Reservoir effluent to the Delaware Aqueduct	1994
NRr2	Neversink Reservoir effluent at Rondout Reservoir	1994
PRr2	Pepacton Reservoir effluent at Rondout Reservoir	1994
WDTO	Cannonsville Reservoir effluent at Rondout Reservoir	1994
Del 10	West Branch Reservoir effluent to the Delaware Aqueduct	1994
Del 18	Kensico Reservoir effluent to the Delaware Aqueduct	1994, 1997, 1998
<i>Catskill</i>		
EAR	Ashokan Reservoir effluent to the Catskill Aqueduct	1994
SRr2	Schoharie Tunnel Outlet to the Esopus Creek	1994
CAT (LEFF)	Kensico Reservoir effluent to the Catskill Aqueduct	1994, 1997, 1998
<i>Croton</i>		
CRO(GH)	New Croton Reservoir effluent to the Croton Aqueduct	1994, 1997, 1998